

CHANGE

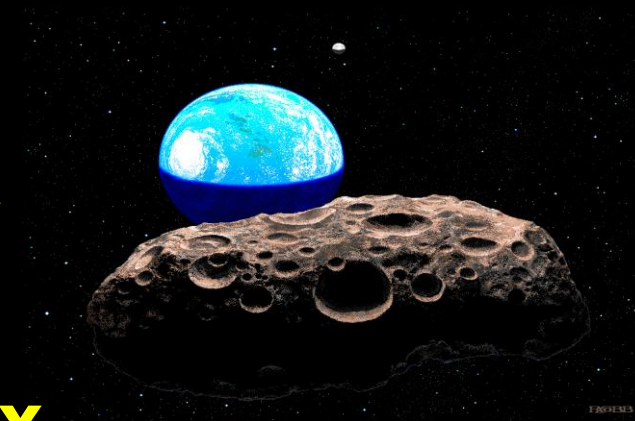
You are living in the period of time that will produce more change for humanity than any previous era in history. It is a time of extraordinary importance that will fundamentally reshape almost every aspect of your life ... Wholesale change is taking place in almost every segment of your reality-and the pace will only increase in the coming years.

John Peterson

The Road to 2015

The 21st Century

- Population Explosion
- Pressures for Development
- Crumbling Infrastructure
- Volatile, Uncertain, Complex, Ambiguous National and World Situations
- Climate Change and Disasters!







KATRINA



CEDAR RAPIDS

NEW YORK

The City and the Storm
Starting on p.17



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Building a Resilient 21st Century:

Resilience Is Not a Four Letter Word!



**2015 Interagency Flood Risk Management
Workshop
Southbridge Hotel and Conference Center
Southbridge, MA**



2 December 2015

Gerald E. Galloway, Jr., PE, PhD

**Center for Disaster Resilience, University of Maryland
Visiting Scholar, USACE IWR**

Member, Resilient America Roundtable of the National Academies



Cautions

**THE SPEAKER DOES NOT
REPRESENT ANYONE OR ANY
AGENCY.**

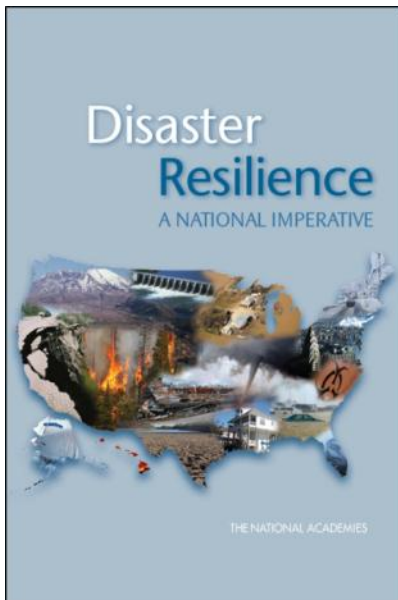
**THE OPINIONS EXPRESSED ARE
HIS OWN AND DO NOT REFLECT,
NECESSARILY, THE POSITIONS
THE UNIVERSITY OF
MARYLAND, THE ARMY CORPS
OF ENGINEERS, THE NATIONAL
ACADEMIES, OR ANYONE ELSE.**



Fear the Turtle

Thanks to Drs Ed Link and Sandra Knight, University of Maryland.

DEALING WITH DISASTERS



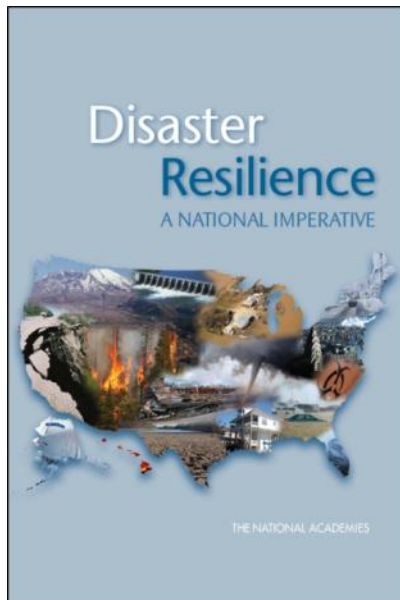
- **Economic damages from natural disasters in the United States continue to grow and are paralleled by growth in the unquantifiable costs of injury and loss of life from disasters**
- **No person or place is immune from disasters or disaster-related losses.**
- **A proactive approach that builds resilience will be more effective at reducing losses of life, property, and economic productivity than current approach**

4 Questions

- What Is Resilience?
- How Do We Manage Resilience?
- What Tools Can We Use to Increase Resilience and Decrease Risk?
- How Do We Know We Are Moving to Resilience?

So, What Is Resilience?

DEFINING RESILIENCE



The ability to **prepare** and **plan** for, **absorb**, **recover** from, or more successfully **adapt** to actual or potential adverse events.

DEFINING RESILIENCE



- *The ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions*

PPD8

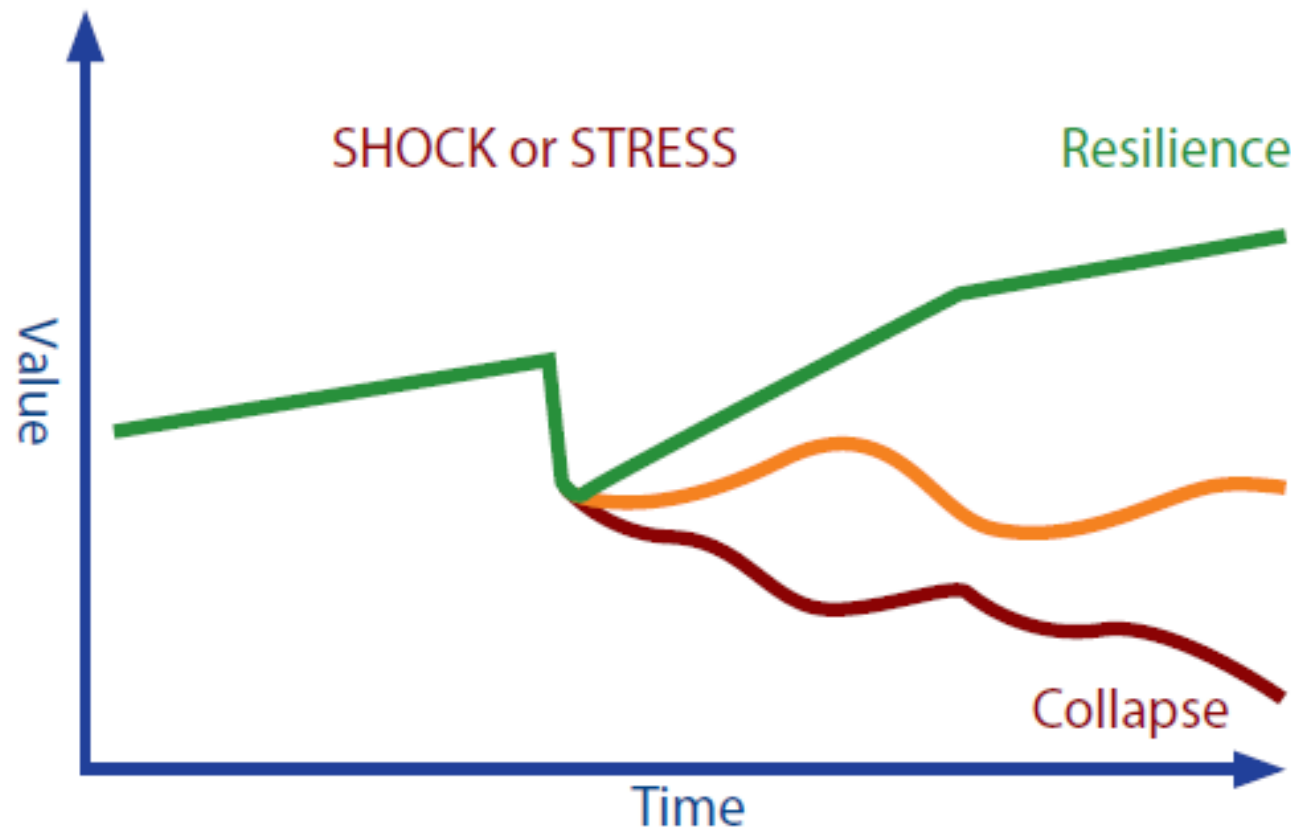
- *Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents*

PPD 21

ROCKY BALBOA



- **Prepare (Train)**
- **Get in the Ring**
- **Get Knocked Down**
- **Get Up**
- **Win**
- **Get Better**



Resilient to What?

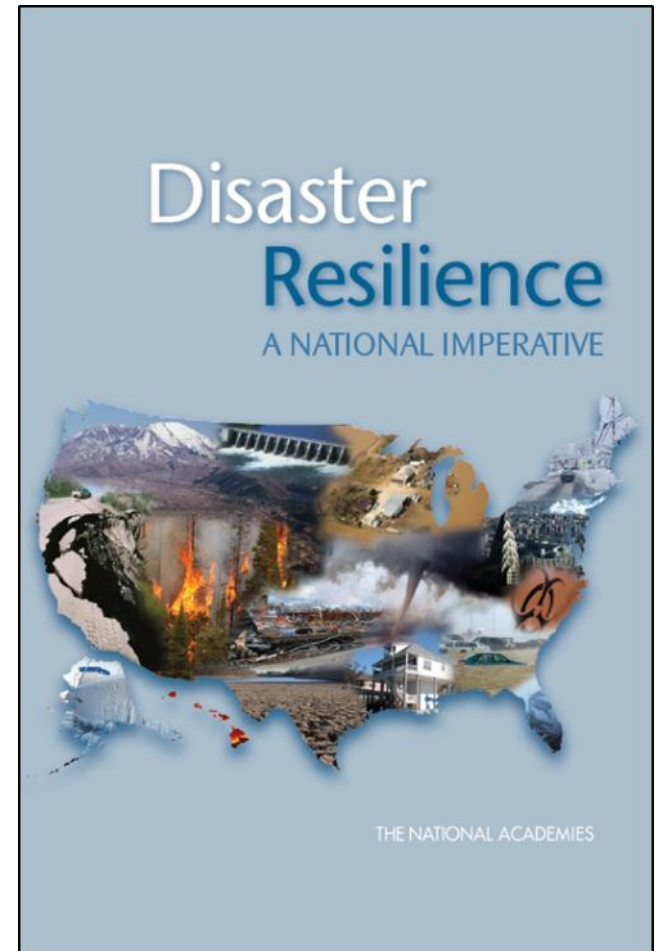
- Disasters
 - » Heat, Storm, Flood , Hurricane, Tornado, Typhoon, Tsunami, Earthquake, Eruptions, Sunspots
- Disruptions
 - » Pandemics, Riots, Infrastructure Failure, Economic Downturns, Etc.

Developing (Managing) Resilience to Disasters Is a Big Part of the Solution

DISASTER RESILIENCE: A NATIONAL IMPERATIVE

4 major recommendations:

- Manage and communicate risk
- Measure resilience in communities
- Build community partnerships and coalitions
- Share information and data to build resilient communities



THE FOUNDATION



- **Risk management/resilience development involves a range of interacting parties: federal, state, local government; home- and business owners; emergency managers; construction industry; insurers; markets; and others.**

- A variety of tools and approaches exist:

Structural (construction-related): e.g., levees, dams, floodways, disaster-resistant construction, “smart” building, and well-enforced building codes

Nonstructural (non-construction-related): e.g., natural defenses, risk mapping, zoning ordinances, economic incentives, hazard forecasting/warning, insurance, and catastrophe bonds

Social and Organizational: e.g. Community health systems; governance; public-private partnerships, etc.

BUILDING RESILIENCE

- Building resilience includes helping communities better understand and approach the use of resilience measures.
- Resilience measures can help communities
 - assess and prioritize needs and goals
 - establish baselines
 - monitor progress and recognize success
 - understand costs (investments) and co-benefits (results)
 - evaluate the effects of different policies and approaches.



- What Tools Can We Use to Increase Resilience and Decrease Risk?

WHAT IS RESILIENT AMERICA?

- A new program at the National Academies of Sciences, Engineering, and Medicine
- Launched in 2014
- Based on the 2012 report, [*Disaster Resilience: A National Imperative*](#)
- A way to engage diverse sets of stakeholders in community action to build resilience

WHY RESILIENT AMERICA?

- Costs of natural disasters and other disruptions are rising.
- Communities want to protect their quality life, property, and people.
- Federal or top-down programs to build resilience get mixed results.
- Bottom-up approaches are needed, but hard to implement alone.
- Greater networks and connections → more opportunities for widespread impacts.

WHAT DOES RESILIENT AMERICA DO?

- Documents key **elements for fostering resilience** at the community level.
- Works with pilot and other communities as they identify and assess risks and develop a **community resilience strategies** and the multiple benefits they can produce
- Organizes workshops, meetings, table top exercises, and other **multi-stakeholder events**.
- Provides **resources***, **experts**, and **information** to better understand, communicate, and manage risk.
- Helps stakeholders and decision makers **identify the interdependencies** within their communities that influence resilience.

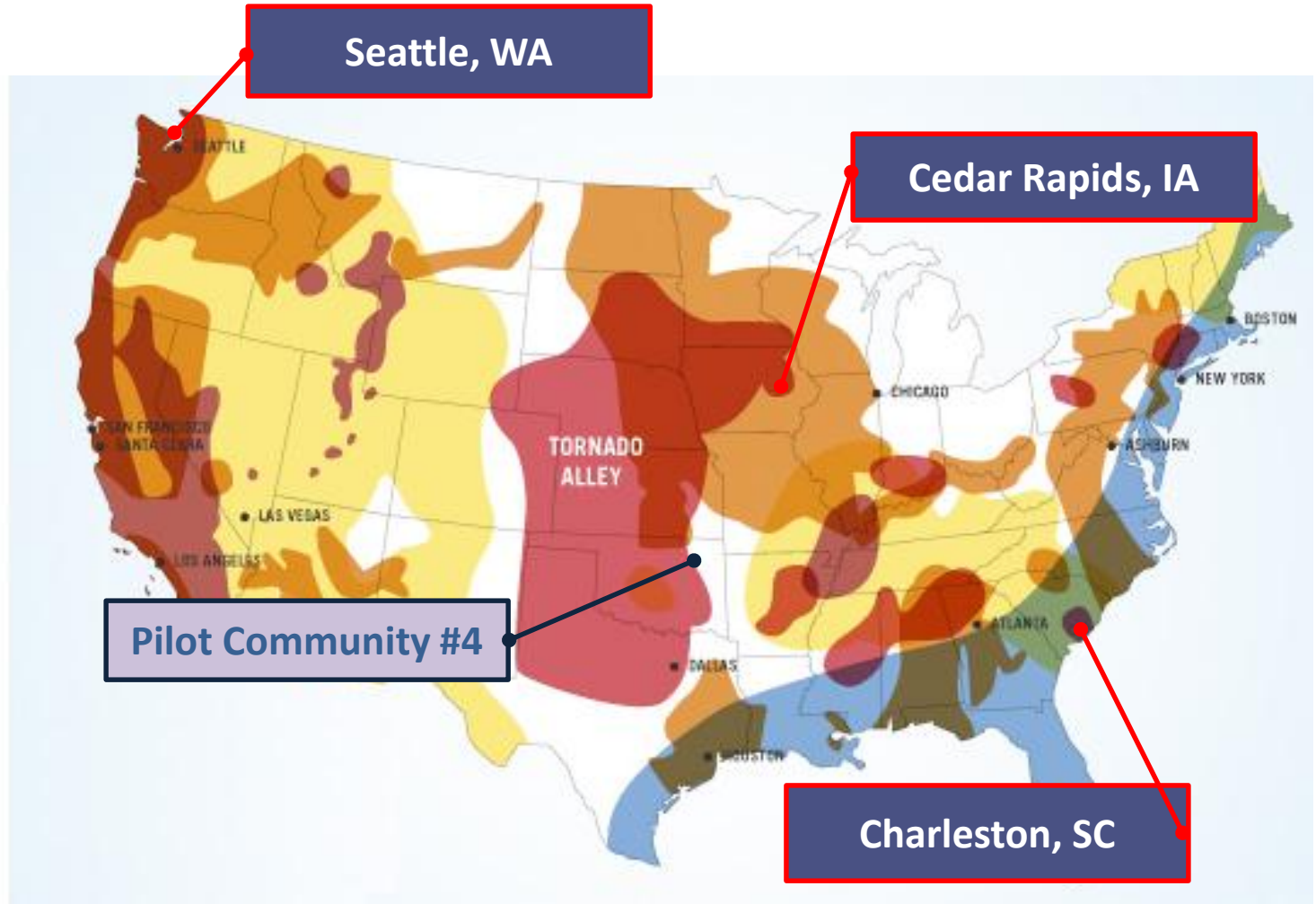
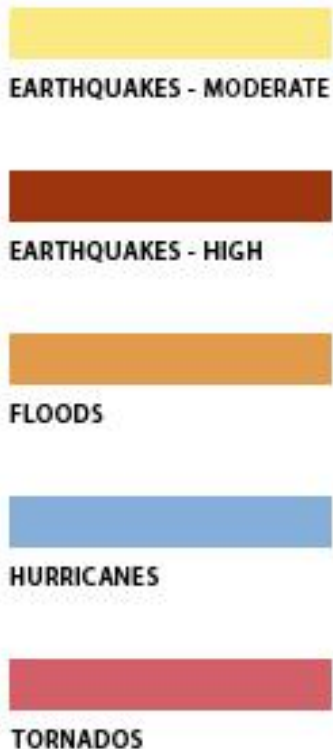
WHO IS INVOLVED?

- **Experts:** social scientists, engineers, risk managers, business professionals, academic researchers, public sector decision makers, federal agencies, nonprofits
- **Community members:** county, state and local government leaders and managers, faith-based organizations, nonprofits, academia, arts community, business leaders
- **Diverse stakeholders across the nation:** private sector, public sector, associations, NGOs, academia, individuals
- **Some partners and collaborators:** DHS, FEMA, Fraunhofer, MACF, Munich Re, NACo, NADO, NOAA, USGS, WEF, Zurich Insurance...

FOUR WORKSTREAMS

- Community Pilot Program
 - Cedar Rapids, IA
 - Charleston, SC
 - Seattle, WA
- Measures and Metrics of Resilience
 - [Measures of Community Resilience: From Lessons Learned to Lessons Applied](#)
 - Developing Community Resilience Measures (July 2015)
- Workshops, Expert Meetings, and Activities
 - [Improving Power System Resilience in the 21st Century](#)
 - [The Role of Disaster Insurance in Improving Resilience](#)
 - [Building Resilience through Science](#)
 - [Koshland Science Museum Extreme Event Game](#)
- Critical Infrastructure and Economic Supply Chain Resilience
 - [Supply Chain Resilience](#)

Pilot Communities



HOW ARE WE DOING IT? – COMMUNITY PILOT PROGRAM

- Resilient America Roundtable members and staff convene, facilitate, and document meetings, workshops, and other interactive events in the communities
- Communities develop their community resilience strategies with help from Resilient America
- Pilot communities interact with Roundtable members, experts and staff, and with other communities that are involved in the program

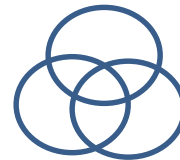
Involvement Across the Community

EXAMINING COMMUNITIES THROUGH 6 ENVIRONMENTS AND COST-BENEFIT STREAMS

1. **Physical**—the built environment
2. **Natural**—natural resources, non-engineered structures, ecosystem services
3. **Economic**—level, variability, and diversity of income sources; access to financial resources
4. **Social/Wellness**—the capacity for people to connect with each other
5. **Human**—the sum of people's skills, knowledge, labor, and good health
6. **Governance**—leadership, power, the ability to influence and enforce policy, standards, rules, regulations

EXAMINING COMMUNITIES THROUGH 3 GOALS AND COST-BENEFIT STREAMS

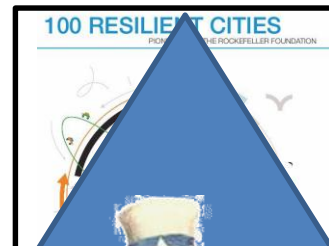
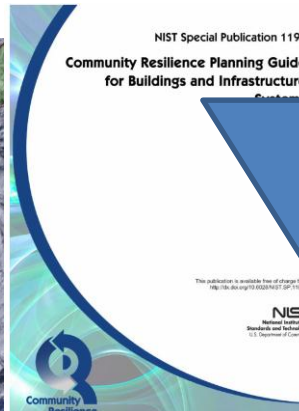
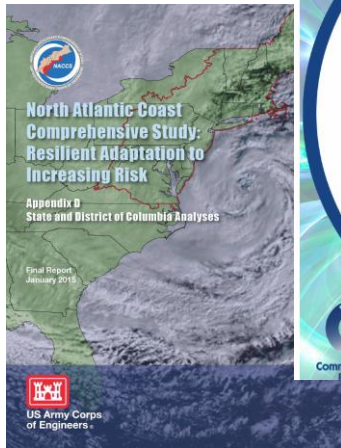
1. **Economic**—the built environment, level, variability, and diversity of income sources; access to financial resources
2. **Environmental**—natural resources, non-engineered structures, ecosystem services
3. **Social**—the capacity for people to connect with each other; the sum of people's skills, knowledge, labor, and good health; leadership, power, the ability to influence and enforce policy, standards, rules, regulations



OTHER PLAYERS



NATIONAL DISASTER RESILIENCE COMPETITION



YOU



CoastSmart Program Resources

- Maryland's Coastal Atlas
- Informational factsheets
- Online Resource Center
- Partnered Trainings
- CoastSmart Scorecard
- Community Grants

<http://dnrweb.dnr.state.md.us/CoastSmart/pdfs/scorecard.pdf>

Silver Jackets <http://www.nfrmp.us/state/>



Coastal Resilience

Coastal Resilience Network



maps.coastalresilience.org

The Nature Conservancy
Protecting nature. Preserving life.™

Coastal Resilience Portal

ResilientAmerica

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

- How Do We Know We Are Moving to Resilience?

Measure Progress

APPROACHES TO MEASURING RESILIENCE

Top Down

NATIONAL



Bottom Up

COMMUNITY



EXAMPLES OF MEASUREMENT APPROACHES



National Flood Insurance Program Community Rating System

A Local Official's Guide to

Saving Lives

Preventing Property Damage

Reducing the Cost of Flood Insurance

FEMA 573

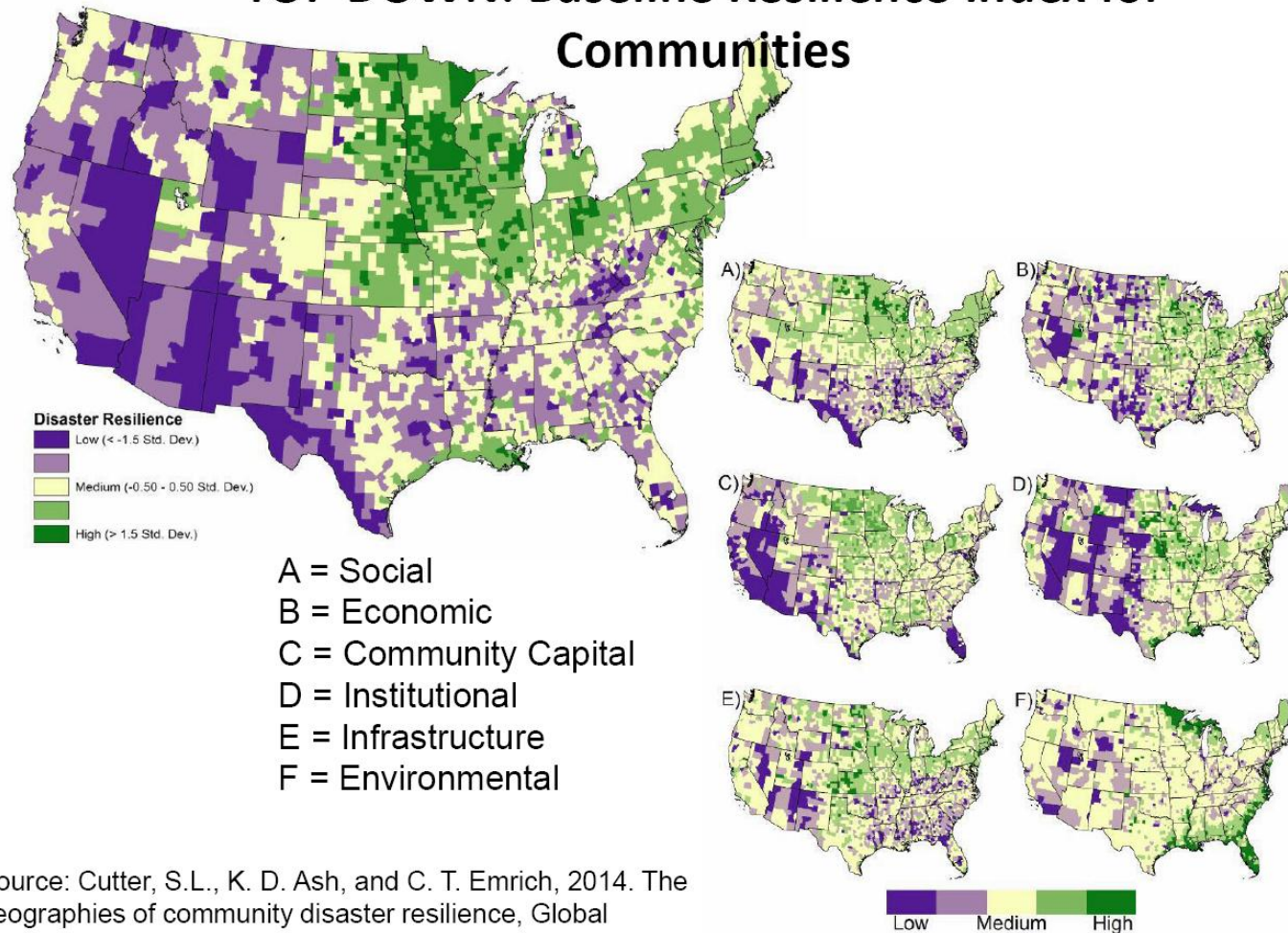


FEMA



EXAMPLES OF MEASUREMENT APPROACHES

TOP DOWN: Baseline Resilience Index for Communities



Source: Cutter, S.L., K. D. Ash, and C. T. Emrich, 2014. The geographies of community disaster resilience, *Global Environmental Change*, in press.

EXAMPLES OF MEASUREMENT APPROACHES



NIST Special Publication 1190

Community Resilience Planning Guide for Buildings and Infrastructure Systems

Volume II

Draft for Public Comment

This Publication is available free of charge from:
<http://dx.doi.org/10.6028/NIST.SP.1190v2>

April 2015



U.S. Department of Commerce
Penny Pritzker, Secretary

National Institute of Standards and Technology
Willie May, Acting Under Secretary of Commerce for Standards and Technology and Acting Director

Community Resilience Planning Guide for Buildings and Infrastructure Systems - Volume II

Draft for Public Comment

27 April 2015

Community Resilience Metrics, Community Resilience Metrics Executive Summary

16. Community Resilience Metrics

Community Resilience Metrics Executive Summary

Metrics are needed to assess the current level of resilience of a community and to assess the potential benefits of actions that could be taken by a community to improve its resilience. To be of value, the metrics selected by the planning team should be accurate, reliable, comprehensive, scalable, affordable, and actionable indicators of the community's capacity to respond to and recover from specified hazard scenarios. The primary metrics used throughout this Guide are the expected recovery times for the various functional clusters of buildings and supporting infrastructure that have been identified by the planning team as being critical to supporting the economic vitality and social well-being of the community. These recovery times are estimated for the specific hazard events and related intensity levels identified by the planning team as being representative of the prevailing hazards that are expected to impact the community. Given a set of physical impacts to the built environment and expected recovery times, it then becomes possible to estimate the associated economic, social, and ecological impacts. Selecting the best metrics for these community-level economic, social, and ecological impacts and predicting how they will be affected by specific community planning and implementation decisions is a challenging and ongoing area of research. Examples of economic, social and ecological metrics that have been suggested in the research literature are reviewed, and summaries of several representative resilience assessment methodologies are provided. While it is just one of three main community-level dimensions to be assessed (along with the social and ecological dimensions), analyzing the economic dimension of planning decisions is perhaps the most tractable and well-developed of the three. The chapter concludes with a discussion of economic modeling approaches and issues.

16.1. Background

Community resilience metrics or indicators come in a wide variety of types. They can be descriptive or quantitative; they can be based on interviews, expert opinion, engineering analysis, or pre-existing datasets. They can also be presented as an overall score or as a set of separately reported scores across a broad spectrum of physical, economic, social, and environmental dimensions. Regardless of the methodologies used to develop and summarize the results, effective community resilience metrics must address two questions (National Academies 2012a):

1. How can community leaders know how resilient their community is?
2. And how can they know if their decisions and investments to improve resilience are making a significant difference?⁶

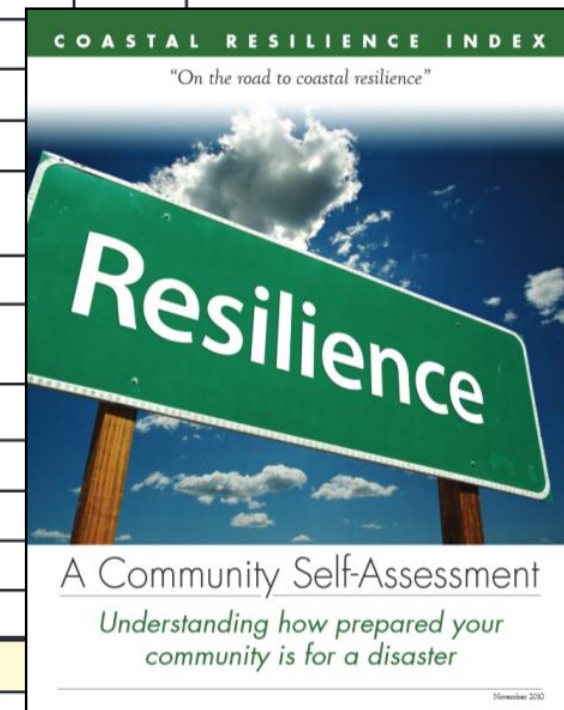
EXAMPLES OF MEASUREMENT APPROACHES

COMMUNITY PLANS AND AGREEMENTS



3. Does your community have the following plans, personnel or agreements in place? Check Yes or No.

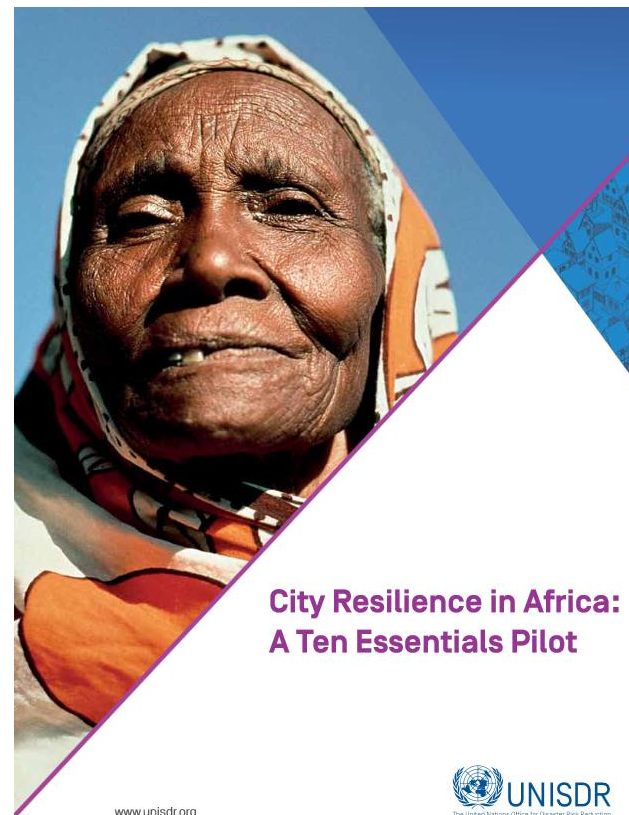
Does your community:	Yes	No
<i>Example: Have a certified floodplain manager?</i>		✓
Participate in the FEMA Community Rating System? (Rating of 8 or lower)		
Use an early flood warning system?		
Have a certified floodplain manager?		
Have planning commissioner(s) with formal training in planning?		
Have a planning staff with credentials from the American Institute of Certified Planners (AICP)?		
Have a FEMA-approved and state EMS-approved mitigation plan?		
If you have an approved mitigation plan, has it been revised in the past two years?		
Have Memorandums of Understanding (MOUs) or Memorandums of Agreement (MOAs) with neighboring communities to help each other during times of disaster?		
Have a comprehensive plan or strategic plan that addresses natural disasters?		
Have a floodplain manager or planner who participates in the following organizations: Association of State Floodplain Managers or State Floodplain Management Association?		
American Planning Association (APA) or state APA chapter?		
American Society of Civil Engineers (ASCE) or state or local section of ASCE?		
American Public Works Association?		
Have first-hand experience with disaster recovery within the last 10 years?		
Have a communication system to use before, during and after a disaster?		
Total number of Yes answers and No answers:		



EXAMPLES OF MEASUREMENT APPROACHES

Ten-point Checklist - Essentials for Making Cities Resilient

- ✓ **Essential 1:** Put in place organization and coordination to understand and reduce disaster risk, based on participation of citizen groups and civil society. Build local alliances. Ensure that all departments understand their role to disaster risk reduction and preparedness.
- ✓ **Essential 2:** Assign a budget for disaster risk reduction and provide incentives for homeowners, low-income families, communities, businesses and public sector to invest in reducing the risks they face.
- ✓ **Essential 3:** Maintain up-to-date data on hazards and vulnerabilities, prepare risk assessments and use these as the basis for urban development plans and decisions. Ensure that this information and the plans for your city's resilience are readily available to the public and fully discussed with them.
- ✓ **Essential 4:** Invest in and maintain critical infrastructure that reduces risk, such as flood drainage, adjusted where needed to cope with climate change.
- ✓ **Essential 5:** Assess the safety of all schools and health facilities and upgrade these as necessary.
- ✓ **Essential 6:** Apply and enforce realistic, risk compliant building regulations and land use planning principles. Identify safe land for low-income citizens and develop upgrading of informal settlements, wherever feasible.
- ✓ **Essential 7:** Ensure education programmes and training on disaster risk reduction are in place in schools and local communities.
- ✓ **Essential 8:** Protect ecosystems and natural buffers to mitigate floods, storm surges and other hazards to which your city may be vulnerable. Adapt to climate change by building on good risk reduction practices.
- ✓ **Essential 9:** Install early warning systems and emergency management capacities in your city and hold regular public preparedness drills.
- ✓ **Essential 10:** After any disaster, ensure that the needs of the survivors are placed at the centre of reconstruction with support for them and their community organizations to design and help implement responses, including rebuilding homes and livelihoods.



**City Resilience in Africa:
A Ten Essentials Pilot**

www.unisdr.org

EXAMPLES OF MEASURES IN THE HUMAN ENVIRONMENT*

Examples of Key Components in the Human Environment	Examples of Potential Measures
<ul style="list-style-type: none">• Healthcare systems & individual health• Education• Ability to address long-term community or individual stressors• Ability to meet basic needs• Housing• Knowledge of social services resources• Accessibility of services, resources, etc. for people with disabilities• Social connectedness• Language access• Workforce training	<ul style="list-style-type: none">• Access to healthcare• High school graduation rates• Access to resources, services, etc. for people with disabilities• % of people making a living wage• % of income spent on housing• % of homelessness• Rate of gentrification and displacement• Ratio of housing burden and transportation costs• Hazard risk awareness• Unemployment/underemployment rate• Availability of workforce training

*Identified by workshop participants at the July 2015 Resilient America Roundtable workshop, “Developing Community Resilience Measures.”

HOW CAN COMMUNITIES START TO THINK ABOUT MEASURES?

- What is your vision for the community?
- What is your vision for the resilience of the community and why?
- What criteria/factors/environments define this resilience vision?
- What goals/ objectives/criteria define these factors?
- What measures define progress or status in meeting these goals?
- What barriers exist to implementing these measures?
- How can you deal with these barriers?

WHAT THE RAR HAS LEARNED SO FAR

- Becoming resilient requires a culture shift.
- Local government is a critical partner, but we need to work with stakeholders across the diverse community sectors.
- Being able to make the business case for resilience may be the most effective way to advance the resilience conversation within a community and its leadership.
- In order to mainstream the concept of resilience, it is important to build it into existing efforts.

WHAT THE RAR HAS LEARNED SO FAR (CONT'D)

- Communities want to learn from each other about their successes and how they are making strides towards resilience through measures.
- Communities need to figure out what their challenges and priorities are before developing measures. Some communities focus on how to use existing data to develop measures instead of first figuring out what they want to measure.
- Involving the entire community in the process of developing and implementing measures can itself be an act of strengthening resilience.
- To increase their resilience, communities want to better understand:
 - how to keep the public engaged
 - level of trust in leadership
 - level of the community's preparedness and understanding of the risks
 - what the community values
 - how community components and systems are interdependent.

The Bottom Line

- 1. The World Around Us Is Changing and Climate Change is a Important Aspect**
- 2. The Risks Associated with Natural and Human Disasters Are Increasing**
- 3. Building Resilience Mitigates These Growing Risks**
- 4. We Need to Be –at ALL Levels - in the Middle of the Resilience Effort**
- 5. Resilience is all about how you think – a culture**

Resilience is a journey, not a destination, and the time to build resilience is now, through a focus on strengthening social cohesion and making smart plans for communities through collaboration across sectors, so that investments - particularly in infrastructure - will yield multiple benefits, or what I call a resilience dividend.

Dr. Judith Rodin

President of The Rockefeller Foundation

Thank You